CLAIMS

1. A bipolar semiconductor device including:

a substrate in which a surface having a specified off-angle from a (000-1) carbon surface of a crystal of a first-conductive-type silicon carbide semiconductor whose base material is silicon carbide, which is a compound of carbon and silicon, is formed; and

at least one drift layer which is formed on a crystal growth surface of the substrate at a specified formation rate with a first- or second-conductive-type silicon carbide semiconductor, where the surface of the substrate having the specified off-angle is taken as the crystal growth surface of the substrate.

2. A bipolar semiconductor device including:

a substrate in which a surface having a specified off-angle from a (000-1) carbon surface of a crystal of a first-conductive-type silicon carbide semiconductor whose base material is silicon carbide, which is a compound of carbon and silicon, is formed;

a drift layer which is formed on a crystal growth surface of the substrate at a specified film growth rate by epitaxial growth of a first-conductive-type silicon carbide, where the surface of the substrate having the

specified off-angle is taken as the crystal growth surface of the substrate; and

at least one layer of a first- or second-conductive-type silicon carbide semiconductor formed on the drift layer.

3. A bipolar semiconductor device including:

a substrate which is to serve as a cathode and in which a surface having a specified off-angle from a (000-1) carbon surface of a crystal of a first-conductive-type silicon carbide semiconductor whose base material is silicon carbide, which is a compound of carbon and silicon, is formed;

a drift layer which is formed on a crystal growth surface of the substrate at a specified film growth rate by epitaxial growth of a first-conductive-type silicon carbide, where the surface of the substrate having the specified off-angle is taken as the crystal growth surface of the substrate; and

a semiconductor layer which is formed on the drift layer and which is of a second-conductive-type silicon carbide to serve as an anode.

4. A bipolar semiconductor device including:

a substrate which is to serve as a collector and in which a surface having a specified off-angle from a (000-1) carbon surface of a crystal of a first-conductive-type silicon carbide semiconductor whose base material is silicon carbide, which is a compound of carbon and silicon, is formed;

a drift layer which is formed on a crystal growth surface of the substrate at a specified film growth rate by epitaxial growth of a first-conductive-type silicon carbide, where the surface of the substrate having the specified off-angle is taken as the crystal growth surface of the substrate;

a second-conductive-type base layer formed on the drift layer; and

a first-conductive-type emitter layer formed on part of the base layer.

5. A bipolar semiconductor device including:

a substrate which is to serve as a collector and in which a surface having a specified off-angle from a (000-1) carbon surface of a crystal of a first-conductive-type silicon carbide semiconductor whose base material is silicon carbide, which is a compound of carbon and silicon, is formed;

a drift layer which is formed on a crystal growth surface of the substrate at a specified film growth rate by epitaxial growth of a silicon carbide, where the surface of the substrate having the specified off-angle is taken as the crystal growth surface of the substrate;

a first-conductive-type grown layer formed on the drift layer;

a second-conductive-type emitter layer formed on the first-conductive-type grown layer;

a contact region formed by ion implantation into the first-conductive-type grown layer via a through hole formed in the second-conductive-type emitter layer; and

a gate electrode formed via an insulating film on the first-conductive-type grown layer and the second-conductive-type emitter layer.

6. The bipolar semiconductor device as claimed in any one of Claims 1 to 5, wherein

the off-angle is within a range of 2 to 10 degrees.

7. The bipolar semiconductor device as claimed in any one of Claims 2 to 5, wherein

the film that is to serve as a drift layer and that is formed by epitaxial growth of silicon carbide is

formed at a film growth rate having a film-thickness increasing rate per hour h of 10 μm/h or more.

8. The bipolar semiconductor device as claimed in any one of Claims 1 to 5, further including

a buffer layer formed between the substrate and the drift layer.

9. A manufacturing method for a bipolar semiconductor device comprising the steps of:

forming a substrate by cutting a crystal of a first-conductive-type silicon carbide semiconductor whose base material is silicon carbide, which is a compound of carbon and silicon, by a surface having a specified angle with respect to a (000-1) carbon surface of the crystal;

forming a drift layer on a crystal growth surface of the substrate at a specified film growth rate by epitaxial growth of a first-conductive-type silicon carbide, where the surface of the substrate having the specified angle is taken as the crystal growth surface; and

forming at least one layer of a first- or second-conductive-type silicon carbide semiconductor on the drift layer.

10. The bipolar semiconductor device manufacturing method as claimed in Claim 9, wherein

the specified angle is within a range of 2 to 10 degrees.

11. The bipolar semiconductor device manufacturing method as claimed in Claim 9, wherein

a film-thickness increasing rate per hour h in the step of forming the drift layer is 10 μm/h or more.

12. The bipolar semiconductor device manufacturing method as claimed in Claim 9, further comprising a step of:

forming a buffer layer between the substrate and the drift layer.